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ABSTRACT

Computerized systems have dramatically altered the way that information can be organized, published, searched and retrieved. This paper: (1) examines the components of subject access in online systems; (2) identifies the potential for subject access enhancements, such as enriching the contents of the database and improving user-system interaction, that meet the information and developmental needs of K-12 students; and (3) reviews the literature and research that are concerned with the effective use of online systems by young people. (Contains 19 references.) (KRN)

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CURRENT AND FUTURE TRENDS IN ENHANCING SUBJECT ACCESS IN ONLINE SYSTEMS TO MEET THE INFORMATION AND DEVELOPMENTAL NEEDS OF YOUNG USERS

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This paper explores the impact of technological change upon subject access to information. Computerized systems have dramatically altered the way that information can be organized, published, searched and retrieved. These changes require an adjustment in the way that K-12 school library media specialists, as welll as other types of librarians, plan and deliver services. The new technology suggests changes in the acquisition and processing of materials, but even more importantly, it has implications for instructional practices. For some time school librarians have been urged to integrate library skills with research assignments, to teach the process of information retrieval rather than the the arrangement of the catalog or the book, and to emphasize critical thinking instead of location skills, but in the 1990's there is a new slant to these issues. The developing design of systems is (or will) resolve some of the need for teaching students how to search and will shift the emphasis from finding information to producing information (and even fiction) in new forms.

It is the goal of this presentation to (1) examine the components of subject access in online systems, (2) within that framework, identify the potential for enhancements that meet the information and developmental needs of K-12 students, and (3) review the literature and research that is concerned with the effective use of online systems by young people. Increasingly, attention is being paid in the market and in the research forum to the special requirements of children and young adults for online access.

SUBJECT ACCESS DEFINED

In 1984 Pauline Cochrane published a seminal series of articles on subject access in the online age. She stated that trying to define "subject access" reminded her of the fable of the blind men and the elephant. If you recall the fable, each of the blind men touches a different part of the elephant and comes away with a limited notion of it. Only when they compare and discuss their perceptions do they begin to understand the "whole animal." Cochrane says, "so it is with subject access," and she cites the complexity and changing boundaries of the topic. Ultimately she offers a consolidated view that takes into consideration the system analyst's perspective but emphasizes the user's view of subject access. (Cochrane 1984)

In defining subject access in the online catalog, Markey (1986)

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included the design of the system itself, the bibliographic record, the user, and the additional tools that we load into the system to improve access to the record, such as authority files, indexes, and class schedules. Hildreth (1987) described the parts of any online system that influence access as the files, functions, and communications of the system, and stated that it is the user interface, that reacts with all three components, that is the most important aspect of the system.

In online subject access writing and research, consideration has been given to enriching the contents of the database as well as to linking related files, but major attention has focused on improving user-system interaction. The next section will discuss developments within all three area of the framework.

SUBJECT ACCESS ENHANCEMENTS

1. Enriching the contents of the database - Enhancements will differ according to the nature of the files.

A) The Information Retrieval (or Reference) (IR) database may offer a bibliogrpahic citation index, expanded to abstracts or full text. In both the IR and online public access catalog (OPAC) databases, reviews and user evaluations may be added. Another example of enrichment is the provision of local holdings in a periodical index file, e.g., in Ebsco's Magazine Abstract Summaries. General encyclopedia databases may allow the user to build note files. Multimedia developments are making it possible to add sound and graphics to the database. The merging of video, audio and computer technologies opens up broad possibilities for user interaction.

B) In the OPAC, the common ground for development is Machine Readable Cataloging (MARC). There is now widespread acceptance of this standard by school libraries but less understanding that the structure is a communications format that does not guarantee content. Some current Library of Congress pre-publication records are issued with the barest amount of detail. There is a growing demand in the market for quality records that include Level 2 cataloging data, e.g., pagination, illustration, subject headings, and notes, as prescribed by AACR2 (Rev.) guidelines. This is subject-rich information for the K-12 user. Some vendors of MARC records are routinely adding grade and reading level information to the record as well as offering Sears Subject Headings and Dewey Classification, features that appeal to school library customers.

The mainstream literature for subject access suggests that publishers could add tables of contents and back-of-the book-index terms to Cataloging-In-Publication (CIP). The theory about enhanced subject access in catalog records for young people has focused primarily on alternative subject heading terms for curriculum units, developmental headings, and other topical vocabulary and needs of children (cited in paper by Murphy, 1990). Sources suggested by researchers included the Hennepin County Public Library Subject Headings for Children's Materials (Berman),

university and state education department's computerized lists of curriculum goals and objectives (Wehmeyer), the Yonkers Public Library list of children's headings, Carolyn W. Lima's A to Zoo list of subject headings for special concepts in children's picture books, and early ALA publications of subject headings to describe children's literature (De Hart and Meder).

2. Improving User-System Interaction: In both OPAC and IR systems, the design includes all of the operational features, such as indexing of files, searching options, online assistance, screen displays, and communications such as menus, windows, keyboards and icons. Added to the system interface mix are the user's information needs, cognitive abilities, knowledge, experience, training, attitudes and aspirations (Cochrane 1984),

Although the structure of the catalog record imposes more design restrictions than IR files, system design overall suffers from a lack of industry standardization. In part, this is due to the infancy of the field, little more than a decade of development for microcomputer applications, even less history for newer technologies such as hypermedia, CD-ROM, and its relations. The fast pace of technological change demands a shakeout period where a variety of innovations flourish. Nonetheless, the diversity of online protocols and displays in current systems require that users learn each system anew. The problems of searching and retrieving are compounded when the user is developmentally less skilled at conceptualizing searches and reading screens.

Markey (1986) has expressed the major difficulties encountered by subject searchers as: discovering the most appropriate terms to use in a search statement, increasing the results when too few records are found, and reducing the results when too many records are retrieved. Hjerrpe defined the fundamental paradox of information retieval as "the need to describe that which you do not know in order to find it", (cited in article by Hildreth, 1989).

Hildreth believes that the browsing model encourages exploration and retrieval in the online catalog. He defines the two approaches supported by most OPACs as: 1) querying, exact phrase-matching with controlled vocabulary (pre-coordinate), and keyword matching with boolean formulation (post-coordinate); and/or 2) browsing that is linear (lists of headings, descriptors, or index terms) and/or non-linear or multi-directional (associative, hypertext, serendipitous). (These features are generally true of IR systems as well.)

A number of online devices, such as truncation, stemming, and spell checks, attempt to facilitate searching. Greater availability of online authority files, thesauri, and classification schedules, have been recommended for additional support. The option to program systems for multi-language commands and different levels of sophistication, e.g., WLN's Laser Cat PAC has five levels of searching strategy from novice to advanced, would satisfy a heterogeneous population.

Hooten (1992) has noted some of the problems that children have in searching online systems, such as spelling, spacing and punctuation. She suggests that systems offer the flexiblity to customize screen displays for low information density. The research of Edmonds and colleagues (1988) identified the difficulties that children have in alphabetizing, spelling, reading, and estimating. New hypermedia software appears to offer some solutions in this area. Graphics, and sometimes sound, replace lengthy written statements. Although a number of IR systems use the mouse pointer, hypermedia design takes particular advantage of this device to allow the searcher the ability to click on different "buttons" and move in a relational direction between files. Hypermedia projects that have been developed for various types of systems will be discussed in the review of research at the end of this paper.

3. Link files to supplement the database - Links can be created between files in the same database or can take the searcher from one database to another.

A. Within a database - An authority file, e.g., Library of Congress Subject Headings (LCSH), is a cross reference tool that can be loaded into an online system to link controlled vocabulary with unauthorized search terms, but is not yet available in many microcomputer catalogs. Classification schedules and embedded terms in these lists have also been used in prototype catalogs to make linkages between search terms.

Special thesauri, such as children's subject headings or curriculum units and goals that were cited earlier, might be incorporated into online systems to link topical vocabulary to traditional headings. Such indexes offer an alternative to enhancing the contents of the file itself.

One interesting method of identifying curriculum materials is the use of "categories" in the Follett Circulation System. A field was created for curriculum headings in the files of the circulation database, as an interim heading that could be searched in these brief records. This category field has proven to be a very useful feature that marks materials for particular teaching units, holidays, genres, etc. Once the materials are barcoded and the category established, a wave of the barwand, or reading by other device, enters this data into records. Several lists of widely-used categories are available from Follett but each library must perform the linkages in-house.

Relational links in hypermedia systems have just been described. This technology facilitates open-ended, exploratory searching. Hypermedia software can link files in the same system or can serve as an interface between databases, as noted below.

B. Between databases - Microcomputer stations can offer menus with access to several different databases, both remote and local. Electronic bulletin boards allow users to communicate with one another as well as offering the capability of downloading files. In a large university library, a hypertext-like mechanism

allows the searcher to select call numbers from local files and, in a separate step, to display and download these files from a remote online catalog. (Mischo 1989) There are other gateways in use, such as the model that allows a searcher of a periodical index to move from a CD-ROM station to an online mode for more current citations.

In my own community (and others), it is possible to link local microcomputer systems and the academic library (State University of New York at Stony Brook) to facilitate awareness of the location of resources, if not to provide interlibrary loan service. A software program called Kermit, purchased from the university for $3.00 (!), allows our high school library to dial into their online catalog. I can also search from my home computer. We envision future (not too far-off) links to the local school library system (where we do have borrowing privileges for serials as well as books) and public library catalogs. Our school district presently has one copy of each of the school and public library union catalogs on CD-ROM. The dial-up method of interaction is/will be available for any microcomputer user who has a modem and is much less expensive than the minicomputer/telecommunications model.

REVIEW OF THE RESEARCH

Research activity has treated a number of issues such as the desirability of data in the catalog record or related files, the impact of system design on student searching and writing, the influence of access to an online catalog on students' use of materials and citations for these materials, and related concerns. All of these studies have been reported since 1987 although the research was conducted a year or so earlier in some cases.

In 1985 I surveyed the total population of microcomputer OPAC software purchasers in school libraries who were identified by software vendors, a small group of 160 pioneers spread over the U.S. and Canada! The findings confirmed my hypotheses that that there was widespread lack of awareness of mainstream cataloging standards, and at the same time, a significant trend toward additional data entry for curriculum units, reading levels, and other school-related information. The strongest influence on MARC conformity was the system itself although, at that time, none could accommodate the full MARC format but some were more MARC-like than others. (Murphy 1987) Follett Software Co. replicated my survey in 1986, slightly revised for developers of children's public as well as school library catalogs, with the much larger population of the company's circulation system users, and found some increase in conformity as well as similar interest in entering additional curriculum information in the bibliographic record. In the intervening years, the developing technology of microcomputer OPACs has addressed the MARC issue and made it easier to implement this standard. Less attention has been given to enhancing the contents of the catalog record with curriculum informaton.

Craver (1992) reported positive findings in her study of the impact of online access on high school students' use of materials and citations for these materials. Craver notes that students who had access to the academic online catalog of the University of Illinois cited more sources from the academic libraries than students who did not have such access. She believes that the availablility of improved subject searching in a new version of that online system contributed to the increase in citations. This researcher suggests the need for bibliographic instruction that covers multi-library applications because students may be introduced to technology not available in the school library.

Lewis (1992) conducted an informal study of children's use of catalog data. The report does not make it clear whether the data requested was from a card or online format (or both) but does indicate that the children preferred computer catalogs. The author asked fourth grade students for the criteria they used to select books for recreational reading and report information. Some of the suggestions were for information already available in the catalog entry, such as pagination and publication date, which indicates a lack of understanding of cataloging detail. Similarly, these students were unaware that fiction could be searched by subject. Other questions were concerned with theme, setting, and character, and again, there was a lack of awareness that theis information can be found in the annotation. Lewis believes that the language of the entry is a barrier to children's access to such information. The author's other recommendations cover the need for more descriptive elements and information about awards, reading level, and popularity. These findings support my recommendations for enriched content in the catalog record as well as Hooten's observations and Edmonds' results regarding children's difficulties with the language and design of current systems.

Edmonds and her colleagues (1988) report on the results of the first Baber grant in which students' use of the catalog was determined by developmental level, experience, and training, i.e., eighth grade students were progressively more skilled than sixth or fourth grade students. Surprisingly, the students preferred the card catalog and were also more adept at using it, perhaps because the online catalog was available at the public library but not in the school library. These researchers indicate several impediments to use of both kinds of catalogs; children had difficulty with alphabetizing full words, did not understand filing conventions, were often unable to identify authors, titles, and call numbers, had trouble in sequencing the steps of a searching activity, and often could not conceptualize what letters or words fell between entries. The authors suggest these improvements in online catalog design: fewer screens per search, fewer lines per screen, briefer bibliogrphic entries, simpler vocabulary, and more tagging of errors. They also make a plea that children receive better training and individual asistance in catalog use.

Jacobson (1991) mentions a number of studies, conducted

within the last several years, in her review of the information retrieval literature. She cites the investigation by Marchionini and others of how elementary students navigate their way through full-text systems, particularly electronic encyclopedias. These researchers found that "users natural
ly gravitate toward a browse mode of searching, which is easier to apply and requires less cognitive effort than constructing a logically ordered search strategy from scratch." Marchionini found in another study that students tended to accept system defaults in a CD-ROM system and had highly interactive strategies rather than planned. In still another examination of high school students' use of a CD-ROM encyclopedia, Marchionini and Liebscher "looked specifically at the differences between analytical and browsing search strategies." They found that students were able to locate information regardless of the search strategy but, interestingly, the group that used the analytical search strategy wrote better essays. These researchers make recommendations that include simpler menu and selection techniques, new structures for full text articles (short sectios with links rather than numerous, full screens), and more investigation of the link between information-seeking activity and the overall learning process.

There are several research projects involving innovative hypermedia designs of OPAC and IR systems for use by children. These designs address the problems encountered by youngsters in some of the studies just cited. Walter and Borgman (1991) have designed a prototype science catalog called Project Seed which consists of a set of Hypercard stacks that support the browsing interface to a Macintosh computer, a set of bibliographic record cards, and a log of monitoring data on system usage. The centerpiece of the design is the browsing interface that conveys subject hierarchy in a set of bookshelves. No typing or spelling skills are needed because the searcher clicks a mouse on a labelled shelf (classification terms are often revised to make them easier to read) to move to smaller bookshelves representing subtopics. List of book titles are displayed under each heading. An interesting aspect of this study is that no directions are given to beginning users; instead, the child is allowed to "play" with the system for about three minutes, then given the assignment, but helped if there are questions about the software. The researchers report tht students are 77.5% successful in locating items for six topics. The difficulties that children have in searching appear to be related more to lack of familiarty with terms in the technology category rather than in the subject hierarchy, and the researchers are addressing this problem by designing a new system that substitutes graphic motifs for text wherever possible.

The Apple Library of Tomorrow (ALOT) program funded another innovative catalog called HyperCard Kids Catalog (De Hart 1989). The catalog incorporates annotaions, reviews and children's comments about material. The searcher can click the mouse on a button for a part of the entry, e.g., the name of a baseball player retrieved in a search of the subject "BASEBALL", additional citations for this player, or a biographical sketch, picture or voice.

Some hypercard-based reference material is commercially available, e.g., HyperAtlas for the Macintosh. A number of schools are also producing their own programs to facilitate researh. Farmer (1991) reports on the HyperCard Library Instruction Project (HLIP), a development of integrated modules of stacks that offer basic library skills instruction to secondary and post-secondary school students. The HLIP stacks include "a stack on basic reference tools, a research strategy stack, and support stacks on specialized reference materials for different content areas." Farmer has received another grant to use these stacks in a cooperative learning venture; her goals are to collect data on the types of difficulties student encounter in conducting library research and to provide a platform for students to peer teach search strategy and organize findings for presentation.

Bertland (1991) divides hypermedia applications for young adult services into three categories, (1) catalogs, (2) informational stacks, and (3) instructions for use of resources, and notes several projects in each area. Some examples are the Zuni/English dictionary with grpahics and sound (another ALOT grant), the Jenks High Schcool Library's (Tulsa, Oklahoma) use of a HyperCard front end to networked computers linked to the card catalogs of the public and university libraries, and another HyperCard front end at Watnatchee High School Library for various references.

A report from Australia (1989) reviewed some of the international literature and research of student use of telecommunication services and cited results from the Australian investigation. The major rationale for making online systems available is their curriculum application. Student activities covered a broad range of information skills, including searching, reading, interpreting and writing. Access to current information, and to a wider range of information, as well as quicker access, were considered the main benefits of electronic information systems. Less important were the opportunity to teach infomation retrieval skills, make contact with other schools, and have access to library cataloging information. The major problem in developing online services was cost; also mentioned were the limited access to equipment within the school and the time-consuming nature of teaching searching skills. Recommendations for improving systems included making changes in the price structure, offering alternative formats such as CD-ROM, adding more help screens, user-friendly protocols, and effective subject indexing, and offering a gateway to and from a national database.

There is another project just funded by the Baber award that seeks to identify specific problems that students have in searching online and CD-ROM databases. (Neumann 1992)

Over the past year I have been investigating the use of online systems, both IR and OPAC in varied formats, in school libraries in the U. S. (Murphy, unpublished) I am interested in

the impact of automation on subject access to information as perceived by these practitioners. There is overwhelming enthusiasm, on the part of library media specialists as well as students, for these systems. Many of the same benefits and problems are cited by the respondents in my study that the Australian study reports. Thus far, I have also learned that: instruction seems to be more one-on-one than whole group; the technology allows students to shift gears and adjust assignments according to information available; the technology allows the disabled learner to have more equity with fellow students because searching is easier; teachers are not as quick as students to adopt the new technology and integrate it into their instructional practices; and library media specialists often do not see the final research paper (or product) so they have no formal means of assessing effective use of systems.

Finally, a report on an Educational Products Information Exchange (EPIE) proposal (Komoski, unpublished). Software evaluation files have been distributed by EPIE, in print and online, for some time. This group has also served as consultant to a number of school districts in the U. S. to assess textbook and curriculum alignment; in this process, they have built databases that they would like to integrate with library resources for a total learning environment. The EPIE proposal has been submitted for grant approval but its funding status is uncertain.

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